Hydro-geochemical impact of fugitive methane on a shallow unconsolidated phreatic aquifer system

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In the last 5 years shale gas development has and will continue to transform the world's energy economy, creating jobs, significant wealth and energy security in regions where development takes place. Unfortunately the necessary extraction technique (i.e. hydraulic fracturing) potentially gives rise to significant environmental impacts the extent and occurrence of which are strongly contested. In particular, contamination of shallow groundwater by fugitive methane originating from shale gas development is one aspect of significant concern, deemed by many to be the most likely adverse impact. Although knowledge regarding the aqueous chemistry of methane is relatively advanced (from related fields of investigation, e.g. landfill and conventional oil and gas contamination investigations etc.) knowledge relating to scales (temporal and spatial) and magnitudes relevant to shale gas development is lacking. In particular fundamental geochemical processes induced by fugitive methane contamination and effective monitoring and detection methodologies have not been proven. In order to address basic science questions associated with fugitive methane and assess monitoring and detection methodologies a shallow aquifer controlled methane release experiment is being conducted at the Borden research aquifer (unconfined, unconsolidated silicate dominated system), Ontario, Canada. During the experiment, gas phase CH4 will be injected through 2 inclined sparging wells at 5 and 10 m depth (at three increasing rates) and the effects monitored physically and geochemically in space and time in both the saturated and unsaturated zones. Following the injection phase, natural attenuation and the ability of the subsurface to assimilate CH4 will be evaluated. Objectives of the study are to: 1. determine the in-situ effects of methane on a shallow unconfined silicate based aquifer and its groundwater quality (temporally and spatially), and 2. determine the most effective monitoring and detection strategies for fugitive methane in such an aquifer. In this presentation the initial results from this controlled release of methane will be shown including initial site set up, background conditions and initial injection impact results. Also results from initial laboratory tests (including batch reactors using site sediment, groundwater and methane exposure to assess likely *in situ* impacts) will be presented.